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**GOST 28147-89 Cipher Suites for Transport Layer Security (TLS)**
**draft-chudov-cryptopro-cptls-04**

**Status of this Memo**



**Copyright Notice**



**Abstract**

This document is intended to register new cipher suites for the Transport Layer Security (TLS) protocol, according to the procedure specified in TLS Protocol standards. These cipher suites are based on Russian national cryptographic standards - GOST R 34.10-94 and GOST R 34.10-2001 public keys, GOST 28147-89 encryption algorithm and GOST R 34.11-94 digest algorithm.

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## 1. Introduction

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This document proposes the addition of new cipher suites to the Transport Layer Security (TLS) protocol to support GOST R 34.11-94 digest, GOST 28147-89 encryption and VKO GOST R 34.10-94/2001 key exchange algorithms. The cipher suites defined here were proposed by CRYPTO-PRO Company for the "Russian Cryptographic Software Compatibility Agreement" community.
Algorithms GOST R 34.10-94, GOST R 34.10-2001, GOST 28147-89 and GOST R 34.11-94 have been developed by Russian Federal Agency of Governmental Communication and Information (FAGCI) and "All-Russian Scientific and Research Institute of Standardization". They are described in [GOSTR341094] (Government Committee of the Russia for Standards, “Information technology. Cryptographic Data Security. Produce and check procedures of Electronic Digital Signatures based on Asymmetric Cryptographic Algorithm, Gosudarstvennyi Standard of Russian Federation (In Russian),” 1994.), [GOSTR341001] (Government Committee of the Russia for Standards, “Information technology. Cryptographic

Data Security.Signature and verification processes of [electronic] digital signature, Gosudarstvennyi Standard of Russian Federation (In Russian)," 2001.), [GOSTR341194] (Government Committee of the Russia for Standards, "Information technology. Cryptographic Data Security. Hashing function, Gosudarstvennyi Standard of Russian Federation (In Russian)," 1994.) and [GOST28147] (Government Committee of the USSR for Standards, "Cryptographic Protection for Data Processing System, Gosudarstvennyi Standard of USSR (In Russian)," 1989.) ([GOST3431095] (Council for Standardization, Metrology and Certification of the Commonwealth of Independence States (EASC), Minsk, "Information technology. Cryptographic Data Security. Produce and check procedures of Electronic Digital Signature based on Asymmetric Cryptographic Algorithm (In Russian)," 1995.), [GOST3431004] (Council for Standardization, Metrology and Certification of the Commonwealth of Independence States (EASC), Minsk, "Information technology. Cryptographic Data Security. Formation and verification processes of (electronic) digital signature based on Asymmetric Cryptographic Algorithm (In Russian)," 2004.), [GOST3431195] (Council for Standardization, Metrology and Certification of the Commonwealth of Independence States (EASC), Minsk, "Information technology. Cryptographic Data Security. Cashing function (In Russian)," 1995.)). Algorithms VKO GOST R 34.10-94/2001 and PRF_GOSTR3411 are described in [CPALGS] (Popov, V., Kurepkin, I., and S. Leontiev, "Additional Cryptographic Algorithms for Use with GOST 28147-89, GOST R 34.10-94, GOST R 34.10-2001, and GOST R 34.11-94 Algorithms," January 2006.). This document defines two configurations:

> anonymous client - authenticated server (only server provides a certificate);
>
> authenticated client - authenticated server (client and server exchange certificates).

The presentation language used here is the same as in [TLS1.2] (Dierks, T. and E. Rescorla, "The TLS Protocol," June 2006.). Since this specification extends [TLS1.2] (Dierks, T. and E. Rescorla, "The TLS Protocol," June 2006.), these descriptions should be merged with those in the TLS specification and any others that extend TLS. This means, that enum types may not specify all possible values and structures with multiple formats chosen with a select() clause may not indicate all possible cases.
The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT","SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119] (Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels," March 1997.).

## 2. CipherSuite Definitions

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### 2.1. Key Exchange

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The cipher suites defined here use the following key exchange algorithms:

| CipherSuite | Key Exchange Algorithm |
|---|---|
| TLS_GOSTR341094_WITH_28147_CNT_IMIT | VKO GOST R 34.10-94 |
| TLS_GOSTR341001_WITH_28147_CNT_IMIT | VKO GOST R 34.10-2001 |
| TLS_GOSTR341094_WITH_NULL_GOSTR3411 | VKO GOST R 34.10-94 |
| TLS_GOSTR341001_WITH_NULL_GOSTR3411 | VKO GOST R 34.10-2001 |

Key derivation algorithms based on GOST R 34.10-94 and GOST R 34.10-2001 public keys (VKO GOST R 34.10-94, VKO GOST R 34.10-2001) are described in [CPALGS] (Popov, V., Kurepkin, I., and S. Leontiev, “Additional Cryptographic Algorithms for Use with GOST 28147-89, GOST R 34.10-94, GOST R 34.10-2001, and GOST R 34.11-94 Algorithms,” January 2006.).

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### 2.2. PRF, Signature and Hash

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The cipher suites described here use HMAC and TLS PRF, as described in section 5 of [TLS1.2] (Dierks, T. and E. Rescorla, “The TLS Protocol,” June 2006.), based on GOST R 34.11-94 hash function (HMAC_GOSTR3411 and PRF_GOSTR3411), with parameter set identified by id-GostR3411-94-CryptoProParamSet (refer to [CPALGS] (Popov, V., Kurepkin, I., and S. Leontiev, “Additional Cryptographic Algorithms for Use with GOST 28147-89, GOST R 34.10-94, GOST R 34.10-2001, and GOST R 34.11-94 Algorithms,” January 2006.)). The same PRF MUST be used for all dependent protocols, such as [EAP-TLS] (Aboba, B. and D. Simon, “PPP EAP TLS Authentication Protocol,” October 1999.).
GOST R 34.10-94/2001 signature is used for CertificateVerify message. GOST R 34.11 digest algorithm ([GOSTR341194] (Government Committee of the Russia for Standards, “Information technology. Cryptographic Data Security. Hashing function, Gosudarstvennyi Standard of Russian Federation (In Russian),” 1994.)) is used for CertificateVerify.signature.gostR3411_hash and Finished.verify_data (see sections 7.4.10 and 7.4.11 of [TLS1.2] (Dierks, T. and E. Rescorla, “The TLS Protocol,” June 2006.))

### 2.3. Cipher and MAC

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The following cipher algorithm and MAC functions are used (for details refer to Section 3.1 (Algorithms)):

| CipherSuite | Cipher | MAC |
|---|---|---|
| TLS_GOSTR341094_WITH_28147_CNT_IMIT | GOST28147 | IMIT_GOST28147 |
| TLS_GOSTR341001_WITH_28147_CNT_IMIT | GOST28147 | IMIT_GOST28147 |
| TLS_GOSTR341094_WITH_NULL_GOSTR3411 | - | HMAC_GOSTR3411 |
| TLS_GOSTR341001_WITH_NULL_GOSTR3411 | - | HMAC_GOSTR3411 |

For all four cipher suites, the use of MAC is slighttly different from the one, described in section 6.2.3.1 of [TLS1.2] (Dierks, T. and E. Rescorla, "The TLS Protocol," June 2006.) for standard stream ciphers, where MAC is calculated from the following data:

```
MACed_data[seq_num] = seq_num +
                      TLSCompressed.type +
                      TLSCompressed.version +
                      TLSCompressed.length +
                      TLSCompressed.fragment;
```

Cipher suites defined in this document use the same input for first record, but for each consequent record the input from all previous records is concatenated:

```
MACed_data[0] + ... + MACed_data[n]
```

## 3. Data Structures and Computations

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### 3.1. Algorithms

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GOST 28147-89 [GOST28147] (Government Committee of the USSR for Standards, "Cryptographic Protection for Data Processing System, Gosudarstvennyi Standard of USSR (In Russian)," 1989.) uses 256-bit key size and 8-byte IV. Cipher suites, defined here, use GOST 28147-89 as a stream cipher in counter mode with S-box parameter from id-Gost28147-89-CryptoPro-A-ParamSet (see [CPALGS] (Popov, V., Kurepkin, I., and S. Leontiev, "Additional Cryptographic Algorithms for Use with

GOST 28147-89, GOST R 34.10-94, GOST R 34.10-2001, and GOST R 34.11-94 Algorithms," January 2006.)) and CryptoPro key meshing algorithm. IMIT_GOST28147 is GOST 28147-89 [GOST28147] (Government Committee of the USSR for Standards, "Cryptographic Protection for Data Processing System, Gosudarstvennyi Standard of USSR (In Russian)," 1989.) in "IMITOVSTAVKA" mode (4 bytes)

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### 3.2. Keys Calculation

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Key calculation is done according to section 6.3 of [TLS1.2] (Dierks, T. and E. Rescorla, "The TLS Protocol," June 2006.), using PRF_GOSTR3411. The parameters are as follows:

```
SecurityParameters.enc_key_length = 32
SecurityParameters.mac_key_length = 32
SecurityParameters.fixed_iv_length = 8
```

Length of necessary key material is 144 bytes.

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### 3.3. Server Certificate

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For these cipher suites this message is required and it MUST contain a certificate, with a public key algorithm matching ServerHello.cipher_suite.

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### 3.4. Server Key Exchange

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This message MUST NOT be used in these cipher suites, because all the parameters necessary are present in server certificate (see [CPPK] (Leontiev, S. and D. Shefanovski, "Using the GOST R 34.10-94, GOST R 34.10-2001, and GOST R 34.11-94 Algorithms with the Internet X.509 Public Key Infrastructure Certificate and CRL Profile," May 2006.)).

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### 3.5. Certificate Request

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This message is used as described in section 7.4.4 of [TLS1.2] (Dierks, T. and E. Rescorla, "The TLS Protocol," June 2006.), and extended as follows:

```
      enum {
          gostr341094(21), gostr34102001(22),(255)
      } ClientCertificateType;
```

gostr341094 and gostr34102001 certificate types identify that the server accepts GOST R 34.10-94 and GOST R 34.10-2001 public key certificates.

```
      enum{
        gostr3411(XX)
      } HashAlgorithm;

      enum{
        gostr341094(XX), gostr34102001(XX)
      } SignatureAlgorithm;
```

gostr3411 hash type identifes that the server accepts GOST R 34.11-94 hash function. It is RECOMMENDED to populate CertificateRequest.certificate_hash only with gostr3411 value, when one of the cipher suites described in this document is chosen.
The server SHOULD populate supported_signature_algorithm field with SignatureAndHashAlgorithm pairs, where HashAlgorithm equals gostr3411 and SignatureAlgorithm matches corresponding ClientCertificateType.

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### 3.6. Client Key Exchange Message

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This message is used as described in section 7.4.7 of [TLS1.2] (Dierks, T. and E. Rescorla, "The TLS Protocol," June 2006.), it is required for these suites, and contains DER-encoded TLSGostKeyTransportBlob structure [X.660] (ISO/IEC, "ITU-T Recommendation X.660 Information Technology - ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)," 1997.).

```
      enum { vko_gost } KeyExchangeAlgorithm;

      struct {
          select (KeyExchangeAlgorithm) {
              case vko_gost: TLSGostKeyTransportBlob;
          } exchange_keys;
      } ClientKeyExchange;
```

ASN1-syntax for this structure is:

```
TLSGostKeyTransportBlob ::= SEQUENCE {
    keyBlob GostR3410-KeyTransport,
    proxyKeyBlobs SEQUENCE OF TLSProxyKeyTransportBlob OPTIONAL
}

TLSProxyKeyTransportBlob ::= SEQUENCE {
    keyBlob GostR3410-KeyTransport,
    cert    OCTET STRING
}
```

GostR3410-KeyTransport is defined in [CPCMS] (Leontiev, S. and G. Chudov, “Using the GOST 28147-89, GOST R 34.11-94, GOST R 34.10-94, and GOST R 34.10-2001 Algorithms with Cryptographic Message Syntax (CMS),” May 2006.).
keyBlob.transportParameters MUST be present.
keyBlob.transportParameters.ephemeralPublicKey MUST be present if the server didn't request client certificate or client's public key algorithm and parameters do not match those of the recipient. Else it SHOULD be omited.
proxyKeyBlobs - (optional) contains key exchange for secondary recipients (for example, for the firewall, which audits connections).
cert - contains secondary recipient's certificate.
Actions of client:
First, the client generates a random 32-byte premaster_secret.
Then shared_ukm is calculated as first 8 bytes of digest of concatenated client random and server random:

```
shared_ukm = GOSTR3411(client_random|server_random)[0..7]
```

Then client chooses a sender key. If keyBlob.transportParameters.ephemeralPublicKey is present, the corresponding secret key MUST be used as a sender key. If it is missing, the secret key, corresponding to the client certificate MUST be used.
Using the sender key and recipient's public key, algorithm VKO GOST R 34.10-94 or VKO GOST R 34.10-2001 (described in [CPALGS] (Popov, V., Kurepkin, I., and S. Leontiev, “Additional Cryptographic Algorithms for Use with GOST 28147-89, GOST R 34.10-94, GOST R 34.10-2001, and GOST R 34.11-94 Algorithms,” January 2006.)) is applied to produce KEK. VKO GOST R 34.10-2001 is used with shared_ukm as UKM.
Then CryptoPro Key Wrap algorithm is applied to encrypt premaster_secret and produce CEK_ENC and CEK_MAC. Again, shared_ukm is used as UKM. keyBlob.transportParameters.encryptionParamSet is used for all encryption operations.
The resulting encrypted key (CEK_ENC) is placed in keyBlob.sessionEncryptedKey.encryptedKey field, it's mac (CEK_MAC) is placed in keyBlob.sessionEncryptedKey.macKey field, and shared_ukm (UKM) is placed in keyBlob.transportParameters.ukm field.

Actions of server:
Server MUST verify, that keyBlob.transportParameters.ukm is equal to GOSTR3411(client_random|server_random)[0..7], before decrypting the premaster_secret.
Server applies VKO GOST R 34.10-94 or VKO GOST R 34.10-2001, (depending on the client public key type), and CryptoPro Key Unwrap algorithm in the simillar manner to decrypt the premaster_secret.
Server MUST verify keyBlob.sessionEncryptedKey.macKey after decrypting the premaster_secret.

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### 3.7. Certificate Verify

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This message is used as described in section 7.4.8 of [TLS1.2] (Dierks, T. and E. Rescorla, "The TLS Protocol," June 2006.). If the client have sent both a client certificate and an ephemeral public key, it MUST send a certificate verify message, as a proof of possession of the private key for provided certificate.
The TLS structures are extended as follows:

```
enum { gostr341094, gostr34102001 }
    SignatureAlgorithm;

select (SignatureAlgorithm) {
    case gostr341094:
        digitally-signed struct {
            opaque gostr341194_hash[32];
        };
    case gostr34102001:
        digitally-signed struct {
            opaque gostr341194_hash[32];
        };
} Signature;

CertificateVerify.signature.gostR3411_hash =
    GOSTR3411(handshake_messages)
```

---

### 3.8. Finished

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This message is used as described in section 7.4.9 of [TLS1.2] (Dierks, T. and E. Rescorla, "The TLS Protocol," June 2006.).

```
Finished.verify_data = PRF_GOSTR3411(master_secret, finished_label,
                                     GOSTR3411(handshake_messages)) [0..11]
```

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## 4. Compatibility

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For historical reasons, some applications use the cipher suites specified herein with [TLS1.0] (Dierks, T. and C. Allen, “The TLS Protocol Version 1.0,” January 1999.), using some features of [TLS1.2] (Dierks, T. and E. Rescorla, “The TLS Protocol,” June 2006.), including cipher-suite dependent PRF, Finished and Certificate Verify computations.

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## 5. Security Considerations

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It is RECOMMENDED that software applications verify signature values, subject public keys and algorithm parameters to conform to [GOSTR341001] (Government Committee of the Russia for Standards, “Information technology. Cryptographic Data Security.Signature and verification processes of [electronic] digital signature, Gosudarstvennyi Standard of Russian Federation (In Russian),” 2001.), [GOSTR341094] (Government Committee of the Russia for Standards, “Information technology. Cryptographic Data Security. Produce and check procedures of Electronic Digital Signatures based on Asymmetric Cryptographic Algorithm, Gosudarstvennyi Standard of Russian Federation (In Russian),” 1994.) standards prior to their use.
Use of the same key for signature and key derivation is NOT RECOMMENDED.
It is RECOMMENDED for both client and server to verify the private key usage period, if this extension is present in the certificate.
The cipher suites TLS_GOSTR341094_WITH_28147_CNT_IMIT and TLS_GOSTR341001_WITH_28147_CNT_IMIT proposed hereby, have been analyzed by special certification laboratory of Scientific and Technical Centre "ATLAS" in appropriate levels of target_of_evaluation (TOE).
It is RECOMMENDED to subject the implementations of these cipher suites to examination by an authorized agency with approved methods of cryptographic analysis.

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## 6. IANA Considerations

This document defines the following new cipher suites, whose values presented here are used by several implementations of the same cipher suites for TLS 1.0, and were described in previous drafts. They are currently listed in the registry as reserved. IANA is requested to update the TLS Cipher Suite registry defined in [RFC5246] with these values.

```
CipherSuite TLS_GOSTR341094_WITH_28147_CNT_IMIT = {0x00,0x80}
CipherSuite TLS_GOSTR341001_WITH_28147_CNT_IMIT = {0x00,0x81}
CipherSuite TLS_GOSTR341094_WITH_NULL_GOSTR3411 = {0x00,0x82}
CipherSuite TLS_GOSTR341001_WITH_NULL_GOSTR3411 = {0x00,0x83}
```

This document defines the following new client certificate types, whose values presented here are used by several implementations of the same suites for TLS 1.0, and were described in previous drafts. They are currently listed in the registry as reserved. IANA is requested to update the TLS ClientCertificateType Identifiers Registry defined in [RFC5246] with these values.

```
enum {
    gostr341094(21), gostr34102001(22)
} ClientCertificateType;
```

This document defines the following new signature algorithm types, whose values are to be assigned from the TLS SignatureAlgorithm Registry defined in [RFC5246].

```
enum{
  gostr341094(XX), gostr34102001(XX)
} SignatureAlgorithm;
```

This document defines the following new hash algorithm types, whose values are to be assigned from the TLS HashAlgorithm Registry defined in [RFC5246].

```
enum {
  gostr3411(XX)
} HashAlgorithm;
```

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## 7. References

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### 7.1. Normative references

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| | |
|---|---|
| [CPALGS] | Popov, V., Kurepkin, I., and S. Leontiev, “Additional Cryptographic Algorithms for Use with GOST 28147-89, GOST R 34.10-94, GOST R 34.10-2001, and GOST R 34.11-94 Algorithms,” RFC 4357, January 2006 (TXT). |
| [CPCMS] | Leontiev, S. and G. Chudov, “Using the GOST 28147-89, GOST R 34.11-94, GOST R 34.10-94, and GOST R 34.10-2001 Algorithms with Cryptographic Message Syntax (CMS),” RFC 4490, May 2006 (TXT). |
| [CPPK] | Leontiev, S. and D. Shefanovski, “Using the GOST R 34.10-94, GOST R 34.10-2001, and GOST R 34.11-94 Algorithms with the Internet X.509 Public Key Infrastructure Certificate and CRL Profile,” RFC 4491, May 2006 (TXT). |
| [GOST28147] | Government Committee of the USSR for Standards, “Cryptographic Protection for Data Processing System, Gosudarstvennyi Standard of USSR (In Russian),” GOST 28147-89, 1989. |
| [GOST3431004] | Council for Standardization, Metrology and Certification of the Commonwealth of Independence States (EASC), Minsk, “Information technology. Cryptographic Data Security. Formation and verification processes of (electronic) digital signature based on Asymmetric Cryptographic Algorithm (In Russian),” GOST 34.310-2004, 2004. |
| [GOST3431095] | Council for Standardization, Metrology and Certification of the Commonwealth of Independence States (EASC), Minsk, “Information technology. Cryptographic Data Security. Produce and check procedures of Electronic Digital Signature based on Asymmetric Cryptographic Algorithm (In Russian),” GOST 34.310-95, 1995. |
| [GOST3431195] | Council for Standardization, Metrology and Certification of the Commonwealth of Independence States (EASC), Minsk, “Information technology. Cryptographic Data Security. Cashing function (In Russian),” GOST 34.311-95, 1995. |
| [GOSTR341001] | Government Committee of the Russia for Standards, “Information technology. Cryptographic Data Security.Signature and verification processes of [electronic] digital signature, Gosudarstvennyi Standard of Russian Federation (In Russian),” GOST R 34.10-2001, 2001. |
| [GOSTR341094] | Government Committee of the Russia for Standards, “Information technology. Cryptographic Data Security. Produce and check procedures of Electronic Digital Signatures based on Asymmetric Cryptographic |

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|---|---|
| | Algorithm, Gosudarstvennyi Standard of Russian Federation (In Russian),” GOST R 34.10-94, 1994. |
| [GOSTR341194] | Government Committee of the Russia for Standards, “Information technology. Cryptographic Data Security. Hashing function, Gosudarstvennyi Standard of Russian Federation (In Russian),” GOST R 34.11-94, 1994. |
| [TLS1.2] | Dierks, T. and E. Rescorla, “The TLS Protocol,” draft-ietf-tls-rfc4346-bis-01 (work in progress), June 2006 (TXT). |

### 7.2. Informative references

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| | |
|---|---|
| [EAP-TLS] | Aboba, B. and D. Simon, “PPP EAP TLS Authentication Protocol,” RFC 2716, October 1999 (TXT). |
| [RFC2119] | Bradner, S., “Key words for use in RFCs to Indicate Requirement Levels,” BCP 14, RFC 2119, March 1997 (TXT, HTML, XML). |
| [TLS1.0] | Dierks, T. and C. Allen, “The TLS Protocol Version 1.0,” RFC 2246, January 1999 (TXT). |
| [X.660] | ISO/IEC, “ITU-T Recommendation X.660 Information Technology - ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER),” ITU-T X.660, 1997. |

## Appendix A. ASN.1 Modules

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Additional ASN.1 modules, referenced here, can be found in [CPALGS] (Popov, V., Kurepkin, I., and S. Leontiev, “Additional Cryptographic Algorithms for Use with GOST 28147-89, GOST R 34.10-94, GOST R 34.10-2001, and GOST R 34.11-94 Algorithms,” January 2006.) and [CPCMS] (Leontiev, S. and G. Chudov, “Using the GOST 28147-89, GOST R 34.11-94, GOST R 34.10-94, and GOST R 34.10-2001 Algorithms with Cryptographic Message Syntax (CMS),” May 2006.).

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### A.1. Gost-CryptoPro-TLS

```
Gost-CryptoPro-TLS
    { iso(1) member-body(2) ru(643) rans(2)
      cryptopro(2) other(1) modules(1) gost-CryptoPro-TLS(16) 1 }
DEFINITIONS ::=
BEGIN
-- EXPORTS All --
-- The types and values defined in this module are exported for
-- use in the other ASN.1 modules contained within the Russian
-- Cryptography "GOST" & "GOST R" Specifications, and for the use
-- of other applications which will use them to access Russian
-- Cryptography services. Other applications may use them for
-- their own purposes, but this will not constrain extensions and
-- modifications needed to maintain or improve the Russian
-- Cryptography service.
    IMPORTS
        Certificate,
        AlgorithmIdentifier
        FROM PKIX1Explicit88 {iso(1) identified-organization(3)
        dod(6) internet(1) security(5) mechanisms(5) pkix(7)
        id-mod(0) id-pkix1-explicit-88(1)}
        id-CryptoPro-algorithms, gostR3410-EncryptionSyntax
        FROM Cryptographic-Gost-Useful-Definitions
            { iso(1) member-body(2) ru(643) rans(2)
              cryptopro(2) other(1) modules(1)
              cryptographic-Gost-Useful-Definitions(0) 1 }
        GostR3410-KeyTransport
        FROM GostR3410-EncryptionSyntax
             gostR3410-EncryptionSyntax
    ;
    id-PRF-GostR3411-94 OBJECT IDENTIFIER ::=
        { id-CryptoPro-algorithms prf-gostr3411-94(23) }
    TLSProxyKeyTransportBlob ::=
        SEQUENCE {
            keyBlob GostR3410-KeyTransport,
            cert    OCTET STRING
        }
    TLSGostKeyTransportBlob ::=
        SEQUENCE {
            keyBlob GostR3410-KeyTransport,
            proxyKeyBlobs SEQUENCE OF
                TLSProxyKeyTransportBlob OPTIONAL
        }
    TLSGostSrvKeyExchange ::=
        SEQUENCE OF
            OCTET STRING (CONSTRAINED BY {Certificate})
    TLSGostExtensionHashHMACSelect ::=
        SEQUENCE {
            hashAlgorithm AlgorithmIdentifier,
```

```
            hmacAlgorithm AlgorithmIdentifier,
            prfAlgorithm AlgorithmIdentifier
        }
    TLSGostExtensionHashHMACSelectClient ::=
        SEQUENCE OF
            TLSGostExtensionHashHMACSelect
    TLSGostExtensionHashHMACSelectServer ::=
        TLSGostExtensionHashHMACSelect

END -- Gost-CryptoPro-TLS
```

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## Appendix B. Acknowledgments

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This document was created in accordance with "Russian Cryptographic Software Compatibility Agreement", signed by FGUE STC "Atlas", CRYPTO-PRO, Factor-TS, MD PREI, Infotecs GmbH, SPRCIS (SPbRCZI), Cryptocom, R-Alpha. The aim of this agreement is to achieve mutual compatibility of the products and solutions.
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